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INTERFACE IN CARTOGRAPHY

by

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Computers have had a great influence on cartography, particularly the process of map production. The tedious work of data preparation and drafting has been largely automated since the early 1970's. Interactive computers now assist in the map design process and computer languages such as Postscript make possible a direct translation between screen image and the photographic plate. A cartography without the computer has become inconceivable.

However, there are aspects of cartography that have been influenced more by the computer than others. For example, the way maps are presented and the way they are used has changed very little. But this should be no surprise. It was, after all, the purpose of computerization in cartography - to do by computer what had been done by hand, to essentially simulate manual processes. As a result of this implied goal, the computer has been primarily used to help the map maker and not necessarily the map user.

The prevalence today of microcomputers is extending computer-assisted cartography beyond the creation of maps on paper. Software for microcomputers is becoming available that represents an interactive form of cartography not been possible with the printed medium. Some programs have implemented a form of cartography that can best be described as an interactive animated cartography. It is evident that the microcomputer is changing how maps are presented and how they are used and they have the potential of helping the map user to a much greater extent than computers have to this point. In the process, the microcomputer may be changing our conception of what maps are and how they are used.

It has become evident that the acceptance and use of the microcomputer is dependent upon its user-interface. The word interface is used to describe an interaction across a 'face' or a boundary between two completely different systems. An example of a face would be the boundary between two different substances that do not mix like oil and water. If these two substances are placed in a container, a face or boundary forms between them. Interface refers then to the interaction across such a face. The term user interface is usually used in reference to the interface between man and computer.

The concept of interface can be applied in cartography in two separate ways. For example, we could say that the map itself serves as an interface to the world. Maps represent an interface to the realities of the spatial world around us. It may also be said that the representational forms within a map embody a user interface. The legend, the selection of colors and the map layout are all aspects of a map's user interface. They embody the cartographers attempt to create an effective interface to the map user. In short, whether we examine the purpose or process of cartography, interface is a central component.

Of concern here is improving the interface between maps and man, to ultimately improve man's understanding and his relationship with the surrounding world. It is evident that the microcomputer is changing how maps are used. This change is occurring not so much because computers are getting smaller but because the user interface to computers is improving. It cartography in the position of adapting to these changes?

Our conception of maps and map use plays an important role in our use of technology. Of course, as cartographers we have a special relationship to maps. They are an important part of our work and an indispensible form of expression. Maps can help us form a mental conception of our surroundings and make possible the depiction of phenomena that are not directly observable. Sometimes we are confronted with 'bad' maps; poorly designed maps that are difficult to read. But we consider maps in general to be 'good.' For the great majority of people that have no special relationship to maps, even well-designed maps are 'bad.'

I would like to start here with a description of five false conceptions that may serve as obstacles to the improvement of the interface between map and map user. The second second section will examine the importance of the medium in cartography. Finally, some recent technological developments and their significance to map use are discussed . First, let us examine the five false conceptions:

I. False Conceptions in Cartography

False conception #1:

Map use is not a problem. All people use maps and know how they should be properly interpreted.

Of course we know this to be wrong and yet we proceed in our work as if it were true. We know that many people do not use maps and that many others do not use them properly. For these people, maps are at times colorful and perhaps pretty, but not useful.

False conception #2:

If map use is a problem then it is the fault of the educational system. Instruction in map reading and map appreciation is not adequate. Maps themselves are not to blame.

Half-wrong. Of course the instruction with maps is inadequate but that is understandable when one considers how much material must be instructed, mathematics, history, etc. Naturally, the instruction in map use is cut short. Some people even consider map reading to be so easy that it is not deserving of special instruction. For these reasons, it is unlikely that we will solve the map use problem through instruction. We must look at maps themselves if we are to make maps more useful.

False conception #3:

Maps are only meant for the few! Many people don't need maps because they are not important to their life!

This view, although widely held, is simply inexcusable. Maps help us to understand the world and can provide information to make important decisions. This function for maps is especially important in a democracy where all should participate in the variety of democratic processes. It should also be noted that this "maps for the few" attitude is furthered by Geographic Information Systems that can only be operated by a few, trained individuals. If such systems exist that are only meant for the few then it is naturally easier to also put maps in this context.

False conception #4:

Maps are tied to the paper medium. Map users must become accustomed to maps in this format.

We know that this is wrong. Maps are already used directly from the screen of the computer. The prevalence of microcomputers is only increasing this trend.

False conception #5:

The representational forms of cartography have all been developed. The computer will not change the methods of generalization and symbolization in cartography.

I think this is wrong as well. But to understand why, let us examine the importance of the medium in cartography.

II. The Medium is the Message

In the thousands of years since the first map was made and especially in the last 500 years or so since the first map was printed, cartography has developed within the limitations of the paper medium. The way we have come to depict information in map form - the symbols, the method of generalization - is largely a result of the paper medium.

Today, every map, even those made by computer, embody the limitations of the paper medium. Our thinking is still in the 'paper-age.' In a sense, we are blinded by the sheet of paper. We can speak of a 'paper-thinking' that still controls the way maps are made. We can't see the possibilities inherrent in a new medium. It will take many years to move beyond this 'paper-thinking' in cartography.

Advances in technology are making it possible to conceive of new and more informative methods to display information about the world. Microcomputers make interactive map use feasible and offer the possibility to display dynamic processes. The renewed interest in cartographic animation, itself a simulation of the film medium, is an indication of an interest to explore other methods of representation and uses of the computer. Microcomputer technology can change the relationship between maps and man. How should we envision this new medium? What form will it take?

III. Toward the Superboard

The recently introduced GO computer and associated PenPoint operating system provides a good example of a workable new medium in cartography. About the size of a photo album, the GO computer is all monitor - there is no keyboard. The LCD screen has a resolution of 100 dots per inch. The computer has 8 megabytes of memory.

The PenPoint operating system is based on a stylus interface and is specially designed to interpret handwriting. For the processing of commands and text input, the operating system incorporates the recognition of meaningful gestures such as caret for insert, cross-out for delete, square-bracket for block-marking and a question mark for help.

The GO computer and others from companies such as GRID, CANON and SONY are the beginning of what are called stylus systems. In many ways, the stylus interface differs more from the now popular mouse interface than the mouse differs from the keyboard. They represent a major advance in computer interface. As advanced as these new computers are, they are only the precursors of a whole new generation of computers. What might the future stylus-type system look like?

Let us call such a computer a 'Superboard.' It would be a relatively flat computer, perhaps 2 inches (5 cm) thick with a large screen of 17 x 12 inches (42 x 30 cm). The Superboard would have to be as portable as a larger book or atlas. The screen resolution might be as much as 300 dots/inch (120 per cm). With such a screen size and resolution, the number of displayable points would be approximately 5000 x 3500 (actual 4960 x 3543) for a total of over 17 million (17,573,280). The use of the Superboard would not be limited to maps but it would also be capable of displaying Hypermedia presentations of sound, picture and text. It would therefore make the interactive use of newspapers and books possible.

It is interesting to examine some of the memory requirements of the Superboard as presented here. For example, over 2mb of memory would be required to simply display a black and white image on the screen (4960 x 3543 = 17573280 bits/ 8 = 2196660 bytes/ or 2.0948982239 mb). With the memory now available in microcomputers, this is not an excessive amount. In fact, the cost of a 1mb chip is between $50 to $100 although the cost of low-energy consuming CMOS chips are considerably more expensive. A grey scale or limited color image would require over 17mb. A true-color image would require over 51 mb. Although these seem like unlikely amounts, the trend is certainly toward cheaper memory chips and microcomputers with large amounts of memory. In terms of long-term storage, current CD-ROM drives store approximately 650 mb. We all realize that with technological developments, 650 mb is by no means an upper limit. Memory requirements do not seem to be a major obtacle to the development of the Superboard. Battery power supply and screen resolution are much more serious impediments. By the mid-1990's such a Superboard will be much more of a reality.

What possibilities would a Superboard present to map use? The answer is related to the type of map. For the use topographic and street maps, a Superboard could be used to implement a combination of 'roaming' and 'zooming' for a better display of the graphic information. The 'roam' function would eliminate many of the problems associated with the use of individual map sheets by making a nearly sheetless presentation of maps possible. The 'zoom' function might be better termed a 'cartographic zoom' since it would be possible to change the information content along with the scale. Initially, perhaps in a step-wise fashion but eventually in a step-less way. Other possibilities with the 'Superboard' would be the presentation of maps with alternative perspectives.

The Superboard would also allow an intelligent binding between the graphic and attribute elements of a map. One could, for example, choose attributes from a list and center the associated graphic objects on an associated map.

For thematic map usage, the major advantage of the Superboard would be the access to more up-to-date information and the possibility of displaying the data in a variety of ways. A single variable, for example, could be depicted with different forms of symbolization and classification options as part of an animation. With a properly designed user interface, it would be possible for the user to extract a great deal more information than is possible with the paper medium. We must, however, be prepared to question all assumptions associated with present-day cartography.

IV. Conclusion

Cartography is in the process of change. Like all technological developments, the computer makes our work both easier and more difficult. The microcomputer accentuates this influence. How must cartography react to these changes? First, we must recognize that there are problems with in map use and that many of these problems can be traced to the static nature of the paper medium. Secondly, cartographers must be in the position to make meaningful contributions to the development of microcomputer map use. The programming of microcomputers, especially computers that incorporate more effective user-interfaces, is neglected in cartographic instruction. We can't expect that computer programmers will develop effective map-user interfaces since they understand little about cartography. Thirdly, we have to begin using new definitions in cartography. The word 'map', for example, should perhaps be redefined to refer to an interactive map display. If the presentation of the information is not controlled by the user - it's not a map. If there is no interaction - it's not a map. If there is no potential for animation - it's not a map. We may eventually realize that what we call maps today are simply static map elements - as much a piece of the puzzle as a single symbol on a map.

It is an exciting time for cartography. We have in the microcomptuer a new medium. A medium that can lead to a new relationship between maps and man. But we have a lot of work ahead of us. Thank you.